renders it very plastic. Every commotion produces a modification of the structure, a vestige, and if the same kind of commotion is repeated the vestige grows stronger and finally develops into an organ. Every organ is the product of its function. Function precedes the formation of organs and is the result of the preservation of a definite and constantly repeated mode of response to a certain kind of stimulus. In the higher sphere of psychic life this preservation of the form of functions is called "memory," and so we may say that every organism is the product of memory. Every bacillus has become what it is by its own doings. Because naturalists have been unable to make organisms we need not jump at the conclusion that organic life has come into the world from the outside, especially as there is no gap between life and inorganic forces, between living substance and so-called inert matter. The transformation of chemical elements into human limbs and brains is an object of common observation.

The significance of Björklund's work consists more in his intentions than in his accomplishments; it lies in his attempt at solving the selfsame problem which plays so prominent a part in religion, "When a man dies shall he live again?" We see that the body decays and nothing is left but ashes. The only answer as to the fate of man is expressed in the Biblical passage, attributed by the author of the third chapter of Genesis to God himself: "For dust thou art and unto dust shalt thou return," and the same truth is most impressively reiterated in Eccl. iii. 19-20. But in spite of everything, man feels instinctively that death does not end all, and he is right. The problem is solved when we understand the part which memory plays in the development of life. Memory builds up organisms, memory shapes our souls, memory makes evolution and progress possible, and memory means immortality. As man does not come from nothing, but is the continuation of his past, so he is not annihilated but his doings and his thoughts, the significance of his life, his soul continues after him. He rests from his labors, but his works follow him. Our life consists of work, and it is in our works that we live on after death.

EDITOR.

MAGIC CIRCLES AND SPHERES.

Magic circles and spheres have been apparently much less studied than magic squares and cubes. We cannot say that this is because their range of variety and development is limited; but it may

be that our interest in them has been discouraged, owing to the difficulty of showing them clearly on paper, which is especially the case with those of three dimensions.

It is the aim of the present paper to give a few examples of what might be done in this line, and to explain certain methods of construction, which are similar in some respects to the methods used in constructing magic squares.

MAGIC CIRCLES.

The most simple form of magic spheres is embodied in all perfect dice. It is commonly known that the opposite faces of a die contain complementary numbers; that is, 6 is opposite to 1, 5 is

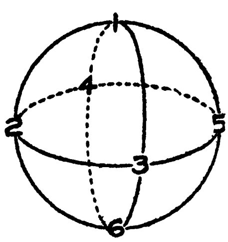

Fig. 1.

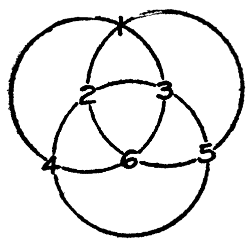

Fig. 2.

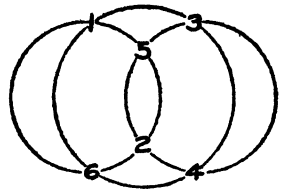

Fig. 3.

opposite to 2, and 4 is opposite to 3—the complementaries in each case adding to 7—consequently, any band of four numbers encircling the die, gives a summation of 14. This is illustrated in Fig. 1,

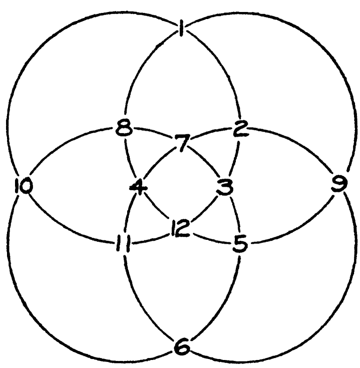

Fig. 4.

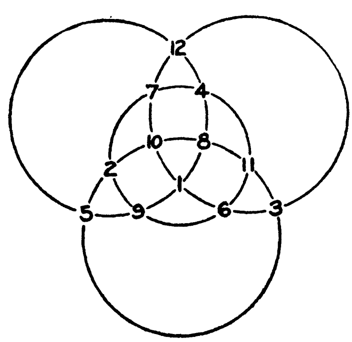

Fig. 5.

which gives a spherical representation of the die; and if we imagine this sphere flattened into a plane, we have the diagram shown in Fig. 2 ,which is the most simple form of magic circles.

Fig. 3 is another construction giving the same results as Fig. 2; the only difference being in the arrangement of the circles. It will be noticed in these two diagrams that any pair of complementary numbers is common to two circles, which is a rule also used in constructing many of the following diagrams.

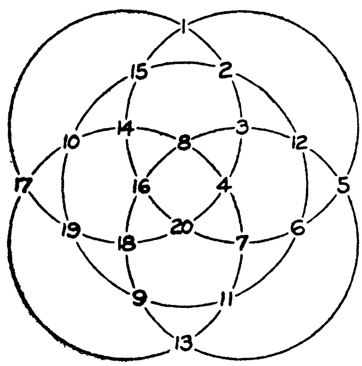

Fig. 6.

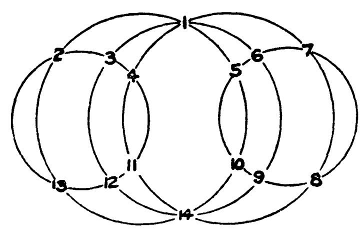

Fig. 7.

Fig. 4 contains the series 1, 2, 3 .... 12 arranged in four circles of six numbers each, with totals of 39. Any one of these circles laps the other three, making six points of intersection on which are

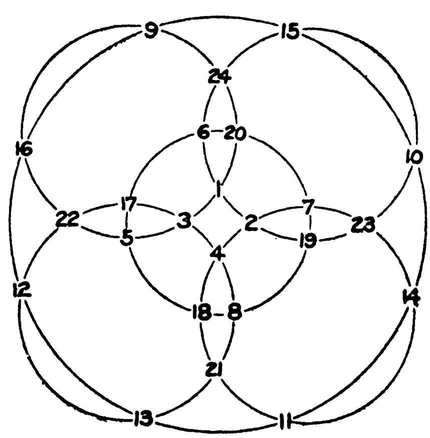

Fig. 8.

placed three pairs of complementary numbers according to the above rule. The most simple way of following this rule is to start by placing number 1 at any desired point of intersection; then by tracing out the two circles from this point, we find their second point of

intersection, on which must be placed the complementary number of 1. Accordingly we locate 2 and its complementary, 3 and its complementary, and so on until the diagram is completed.

Fig. 5 is the same as Fig. 4, differing only in the arrangement of the circles.

Fig. 6 contains the series 1, 2, 3 .... 20 arranged in five circles of eight numbers each, with totals of 84.

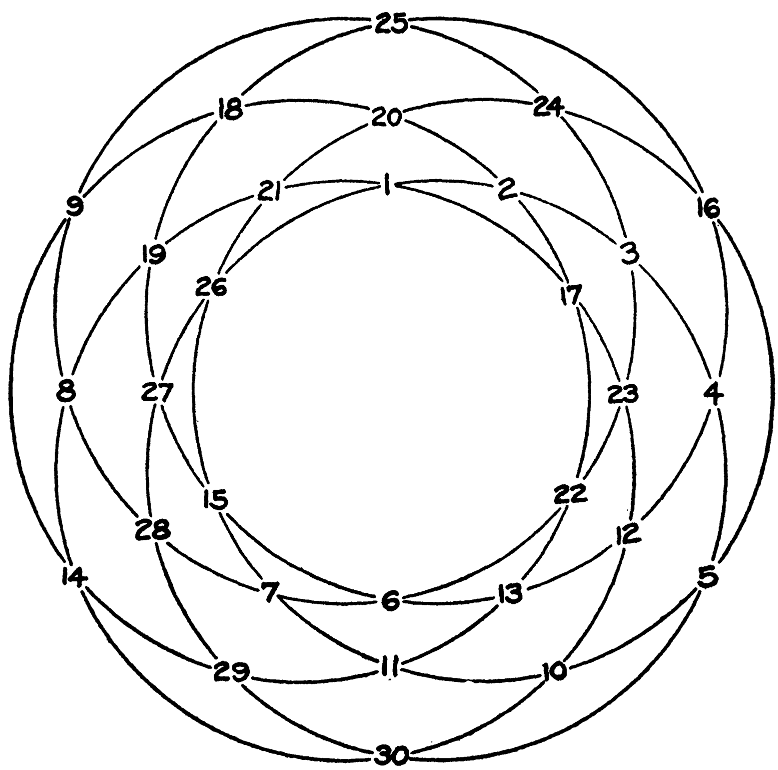

Fig. 9.

Fig. 7 contains the series 1, 2, 3....14 arranged in five circles of six numbers each, with totals of 45. It will be noticed in this diagram, that the 1 and 14 pair is placed at the intersections of three circles, but such intersections may exist as long as each circle contains the same number of pairs.

Fig. 8 contains the series 1, 2, 3....24 arranged in six circles of eight numbers each, with totals of 100.

Fig. 9 contains the series 1, 2, 3 ....30 arranged in six circles

of ten numbers each, with totals of 155. Also, if we add together any two diametrical lines of four and six numbers respectively, we will get totals of 155; but this is only in consequence of the complementaries being diametrically opposite.

Fig. 10 contains the series 1, 2, 3 ....40 arranged in eight circles of ten numbers each, with totals of 205.

Fig. 11 contains the series 1, 2, 3 .... 8 arranged in eight circles of four numbers each, with totals of 18. This diagram involves a

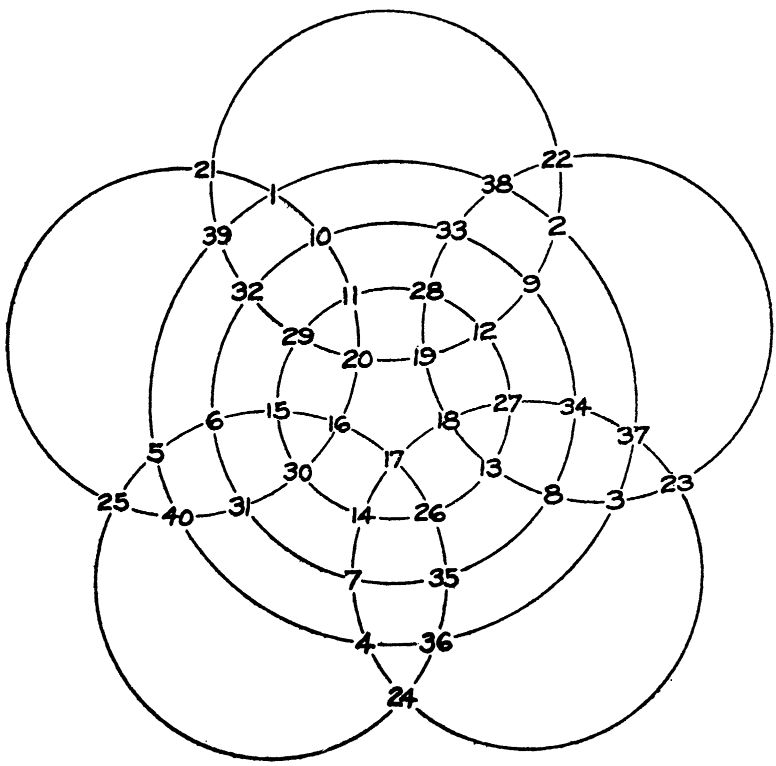

Fig. 10.

feature not found in any of the foregoing examples, which is due to the arrangement of the circles. It will be noticed that each number marks the intersection of four circles, but we find that no other point is common to the same four circles, consequently we need more than the foregoing rule to meet these conditions. If we place the pairs on horizontally opposite points, all but the two large circles will contain two pairs of complementaries. The totals of the two

large circles must be accomplished by adjusting the pairs. This adjustment is made in Fig. 12, which shows the two selections that will give totals of 18.

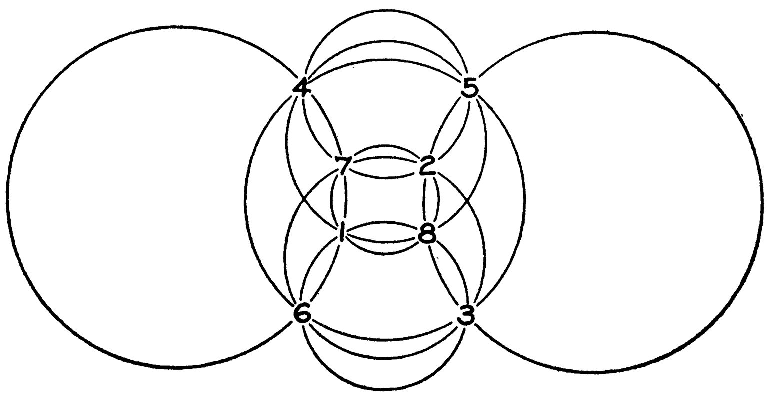

Fig. 11.

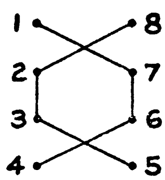

Fig. 12.

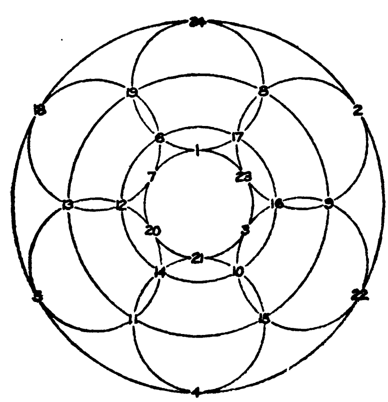

Fig. 13.

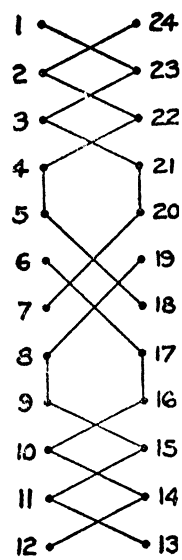

Fig. 14

Fig. 13 contains the series 1, 2, 3 .... 24 arranged in ten circles of six numbers each, with totals of 75. This is accomplished by placing the pairs on radial lines such that each of the six equal

circles contains three pairs. It then only remains to adjust these pairs to give the constant totals to each of the four concentric circles. Their adjustment is shown diagrammatically in Fig. 14, which is one of many selections that would suit this case.

Fig. 15 contains the series 1, 2, 3 .... 12 arranged in seven circles and two diametrical lines of four numbers each with totals of 26.

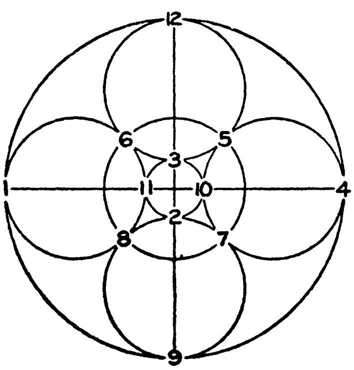

Fig. 15.

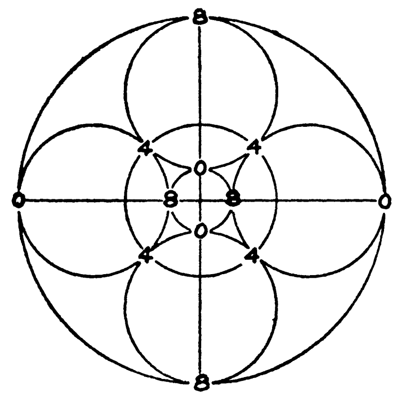

Fig. 16.

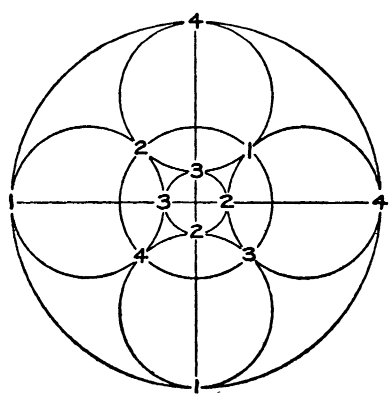

Fig. 17.

The large number of tangential points renders this problem quite difficult, and it appears to be solvable only by La Hireian methods. It was derived by adding together the respective numbers of the two primary diagrams Figs. 16 and 17, and Fig. 17 was in turn derived from the two primary diagrams Figs. 18 and 19.

We begin first with Fig. 16 by placing four each of the numbers 0, 4, and 8 so that we get nine totals amounting to 16. This

is done by placing the 4's on the non-tangential circle; which leaves it an easy matter to place the o's and 8's in their required positions. Fig. 17 must then be constructed so as to contain three sets of the series 1, 2, 3, 4; each set to correspond in position respective to the

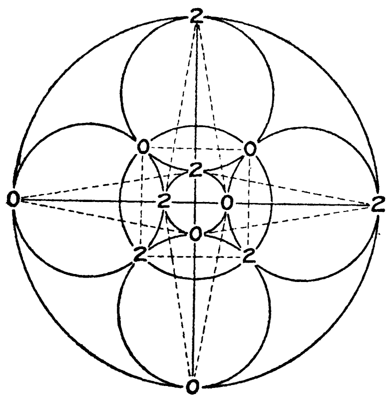

Fig. 18.

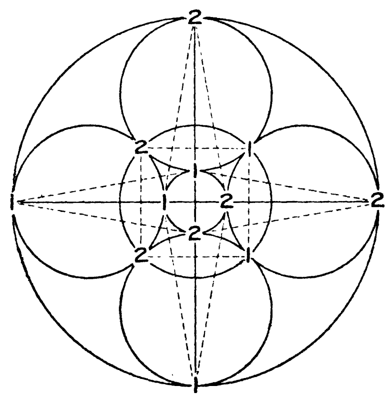

Fig. 19.

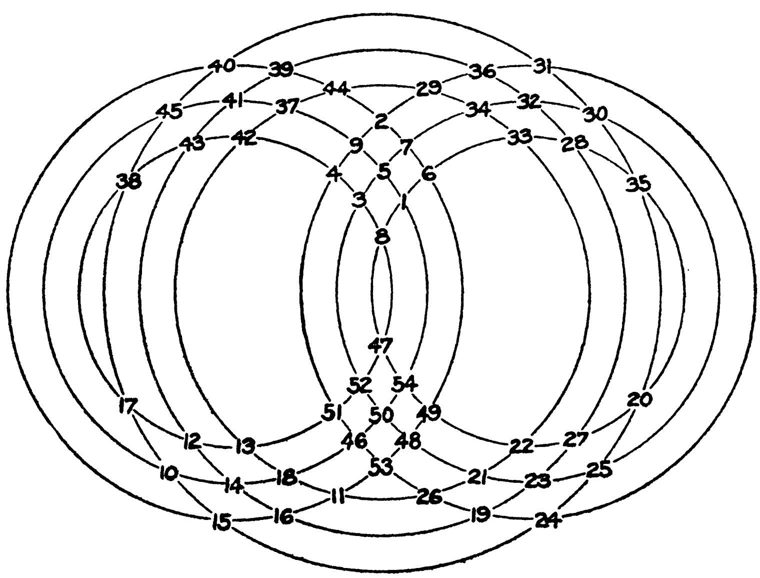

Fig. 20,

three sets in Fig. 16, and give totals of 10. This could be done by experiment, but their positions are much easier found with the two diagrams, Figs. 18 and 19. Fig. 18 contains six o's and six 2's

giving totals of 4, while Fig. 19 contains six 1's and six 2's giving totals of 6. It will be noticed in Fig. 16 that the 0's form a horizontal diamond, the 8's a vertical diamond and the 4's a square, which three figures are shown by dotted lines in Figs. 18 and 19. Besides giving the required totals, Figs. 18 and 19 must have their numbers so arranged, that we can add together the respective diamonds and squares, and obtain the series 1, 2, 3, 4 for each diamond

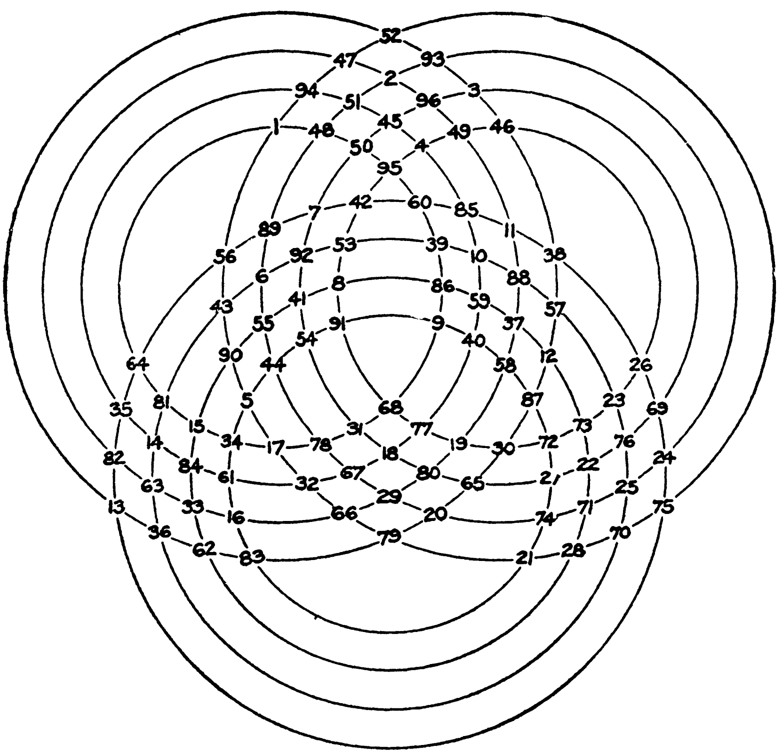

Fig. 21.

and square, which is shown in Fig. 17. Figs. 17 and 16 are then added together which gives us the result as shown in Fig. 15.

This diagram was first designed for a sphere, in which case the two diametrical lines and the 5, 6, 7, 8 circle were great circles on the sphere and placed at right angles to each other as are the three circles in Fig. 1. The six remaining circles were equal and had their tangential points resting on the great circles. The dia-

grams used here are easier delineated and much easier to understand than the sphere would have been.

Fig. 20 contains the series 1, 2, 3 .... 54 arranged in nine circles of twelve numbers each with totals of 330. The arrangement also forms six 3×3 magic squares.

1	2	3	4
4	3	2	1
2	1	4	3
3	4	1	2

Fig. 22.

0	92	44	48
44	48	0	92
48	44	92	0
92	0	48	44

Fig. 23.

0	44	48	92
4	40	52	88
8	36	56	84
12	32	60	80
16	28	64	76
20	24	68	72

Fig. 24.

We begin this figure by placing the numbers 1 to 9 in magic square order, filling any one of the six groups of points; then, according to the first general rule, we locate the complementaries of each of these numbers, forming a second and complementary

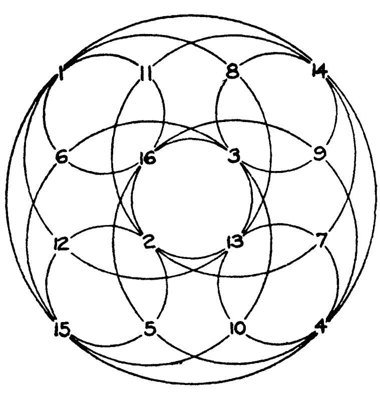

Fig. 25.

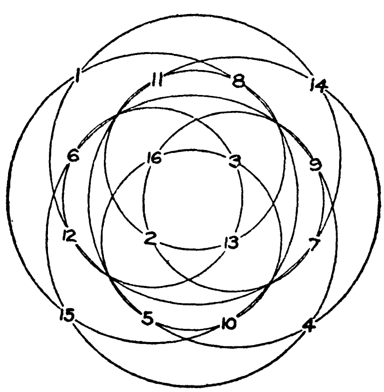

Fig. 26.

square. We locate the remaining two pairs of squares in the same manner. The pairs of squares in the figure are located in the same relative positions as the pairs of numbers in Fig. 3, in which respect the two figures are identical.

Fig. 21 contains the series 1, 2, 3 .... 96 arranged in twelve

circles of sixteen numbers each, with totals of 776.. The sum of the sixteen numbers in each of the six squares is also 776. These squares possess the features of the ancient Jaina square, and are constructed by the La Hireian method as follows.

The series 0, 4, 8, 12 .... 92 are arranged in six horizontal groups of four numbers, as shown in Fig. 24, by running the series down, up, down, and up through the four respective vertical rows. the upper horizontal row of Fig. 24 is used to form the primary square Fig. 23; likewise, five other squares are formed with the remaining groups of Fig. 24. These six squares are each, in turn, added to the primary square, Fig. 22, giving the six squares in Fig. 21. There is no necessary order in the placing of these squares, since their summations are equal.

Figs. 25 and 26 show the convenience of using circles to show up the features of magic squares. The two diagrams represent the same square, and show eighteen summations amounting to 34.

MAGIC SPHERES.

In constructing the following spheres, a general rule of placing complementary numbers diametrically opposite, has been followed, in which cases we would term them regular. This conforms with a characteristic of magic squares and cubes, as described by Mr. W. S. Andrews in his book on *Magic Squares and Cubes.*

Fig. 27 is a sphere containing the series 1, 2, 3 .... 26 arranged in nine circles of eight numbers each, with totals of 108.

In this example, it is only necessary to place the pairs at diametrically opposite points; because all the circles are great circles, which necessitates the diametrically opposite position of any pair common to two or more circles. Otherwise we are at liberty to place the pairs as desired; so, in this sphere it was chosen to place the series 1, 2, 3....9 in magic square form, on the front face, and in consequence, we form a complementary square on the rear face.

Fig. 28 is a sphere containing the series 1, 2, 3 .... 26, arranged in seven circles of eight numbers each, with totals of 108.

This was accomplished by placing the two means of the series at the poles, and the eight extremes in diametrically opposite pairs on the central horizontal circle. In order to give the sphere "regular" qualities, as mentioned before, the remaining numbers should be placed as shown by diagram in Fig. 29. This shows the two selections for the upper and lower horizontal circles. The numbers for the upper circle are arranged at random, and the numbers in the

lower circle are arranged in respect to their complementaries in the upper circle.

Fig. 30 is a sphere containing the series 1, 2, 3 .... 62 arranged in eleven circles of twelve numbers each, with totals of 378.

This is a modification of the last example and represents the parallels and meridians of the earth. Its method of construction is also similar, and the selections are clearly shown in Fig. 31.

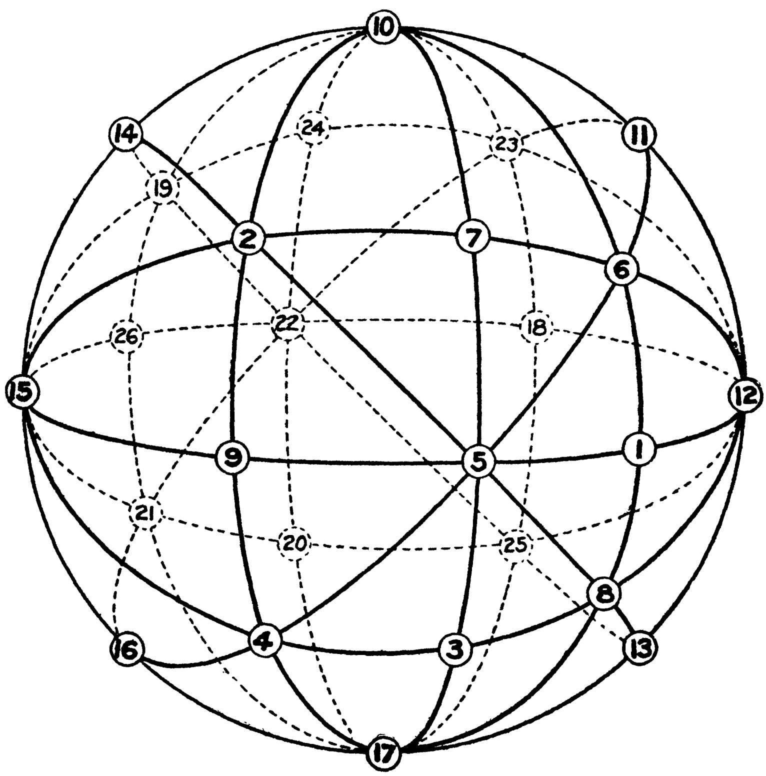

Fig. 27.

Fig. 32 shows two concentric spheres containing the series 1, 2, 3 .... 12 arranged in six circles of four numbers each, with totals of 26. It also has three diametrical lines running through the spheres with totals of 26.

The method for constructing this is simple, it being only necessary to select three pairs of numbers for each sphere and place the complementaries diametrically opposite each other.

Fig. 33 is the same as the last example with the exception that

two of the circles do not give the constant total of 26; but with this sacrifice, however, we are able to get twelve additional summations of 26, which are shown by the dotted circles in Figs. 34, 35 and 36. Fig. 34 shows the vertical receding plane of eight numbers; Fig. 35, the horizontal plane; and Fig. 36, the plane parallel to the picture, the latter containing the two concentric circles that do not give totals of 26.

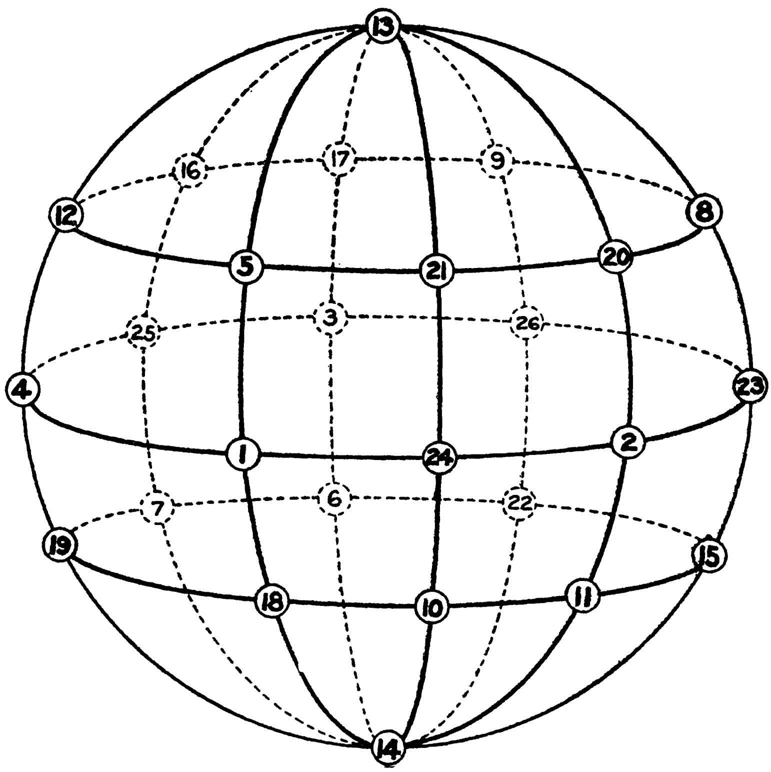

Fig. 28.

In this example all pairs are placed on radial lines with one number in each sphere which satisfies the summations of the twelve dotted circles. The selections for the four concentric circles are shown in Fig. 37. The full lines show the selections for Fig. 34 and the dotted lines for Fig. 35. It is impossible to get constant totals for all six concentric circles.

Fig. 38 is a sphere containing the series 1, 2, 3 .... 98, ar-

ranged in fifteen circles of sixteen numbers each, with totals of 792. It contains six 3×3 magic squares, two of which, each form the nucleus of a 5×5 concentric square. Also, the sum of any two diametrically opposite numbers is 99.

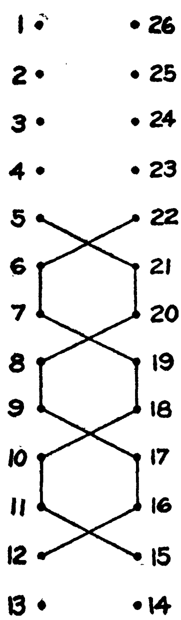

Fig. 29.

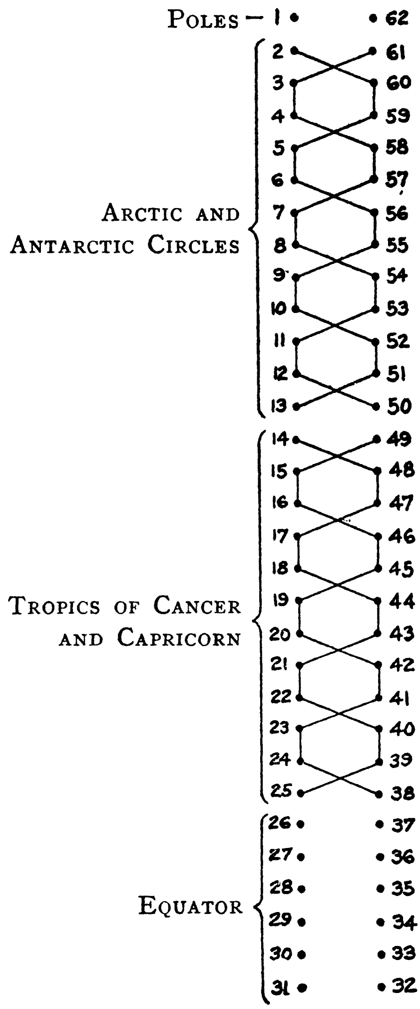

Fig. 31.

To construct this figure, we must select two complementary sets of 25 numbers each, that will form the two concentric squares;

and four sets of 9 numbers each, to form the remaining squares, the four sets to be selected in two complementary pairs.

This selection is shown in Fig. 39, in which the numbers enclosed in full and dotted circles represent the selection for the front and back concentric squares respectively. The numbers marked with T, B, L and R represent the selections for the top, bottom, left and right horizon squares respectively.

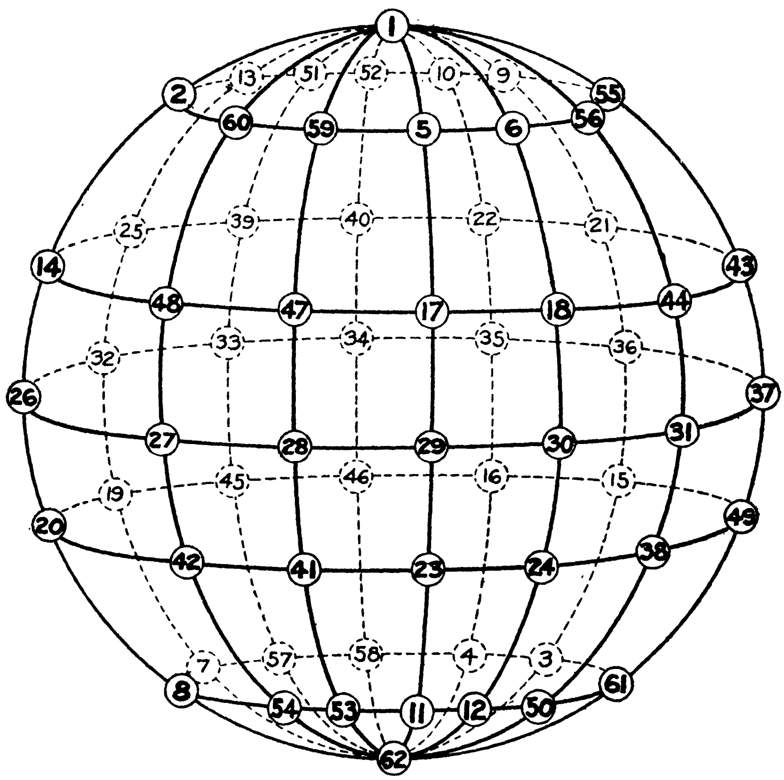

Fig. 30.

After arranging the numbers in the top horizon square, we locate the complementary of each number, diametrically opposite and accordingly form the bottom square. The same method is used in placing the left and right square.

The numbers for the front concentric square are duplicated in Fig. 40. The numbers marked by dot and circle represent the selection for the nucleus square, and the diagram shows the selections

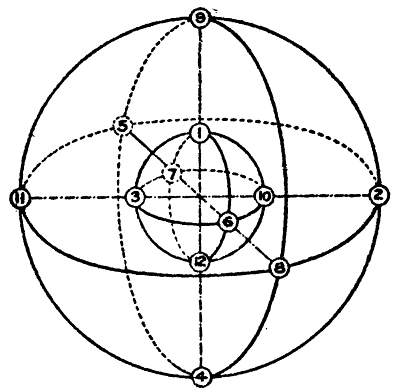

Fig. 32.

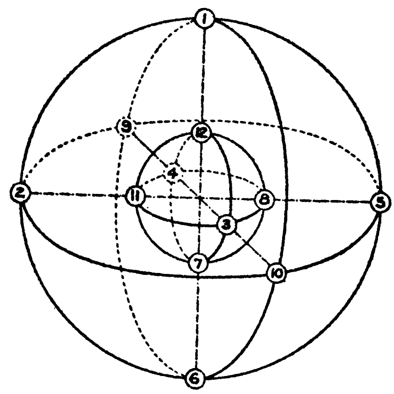

Fig. 33.

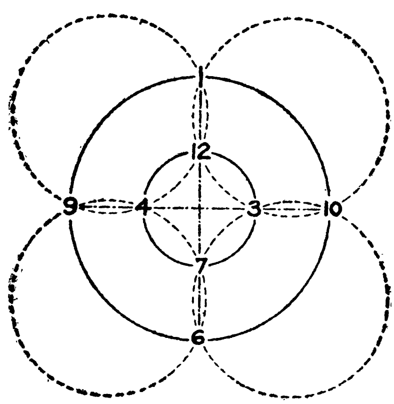

Fig. 34.

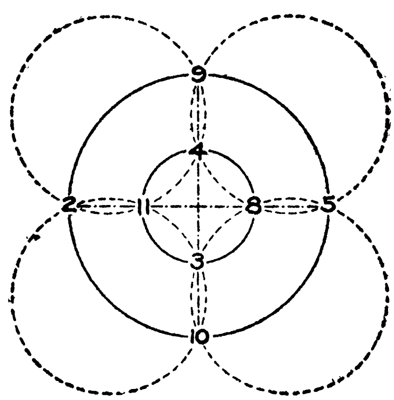

Fig. 35.

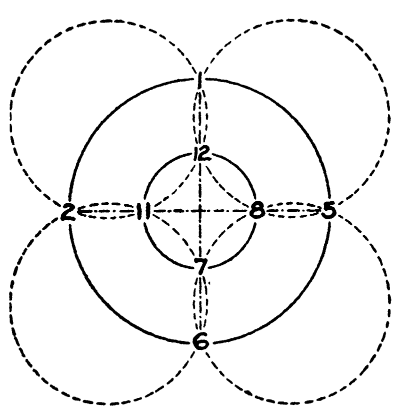

Fig. 36.

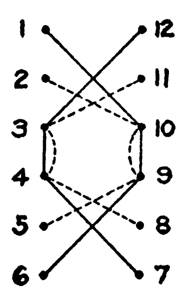

Fig. 37.

for the sides of the surrounding panel, the numbers 4, 70, 34 and 40 forming the corners.

By placing the complementaries of each of the above 25 numbers, diametrically opposite, we form the rear concentric square.

After forming the six squares, we find there are twelve numbers left, which are shown in Fig. 41. These are used to form the four horizon triads. Two pairs are placed on the central circle, and by selection, as shown in the diagram, we fill in the other two

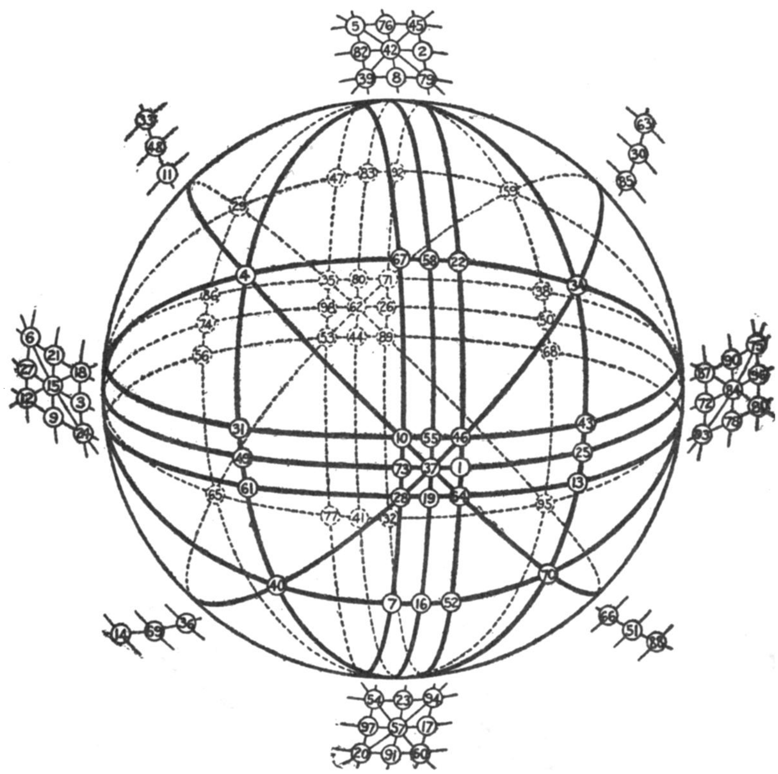

Fig. 38.

circles with complementary numbers diametrically opposite. The above selection is such that it forms two groups of numbers, each with a summation of 198; this being the amount necessary to complete the required summations of the horizon circles.

There are many selections, other than those shown in Fig. 39, which could have been taken. A much simpler one would be to select the top 25 pairs for the front and back concentric squares,

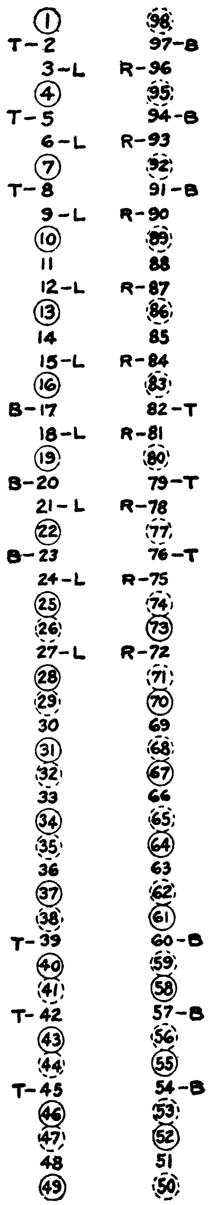

Fig. 39.

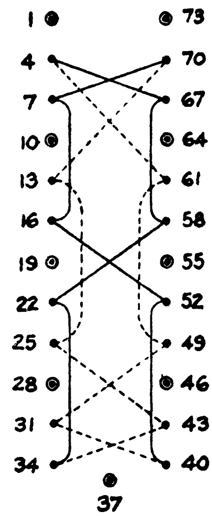

Fig. 40.

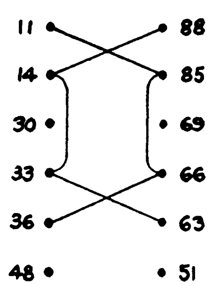

Fig. 41.

the next 9 pairs for the top and bottom squares, the next 9 pairs for the left and right squares, and the remaining 6 pairs for the triads. In such a selection, all the numbers in each square would be in sequence.

HARRY A. SAYLES.

SCHENECTADY, N. Y.

THE ESTABLISHMENT OF THE CRIMINOLOGICAL INSTITUTE IN ST. PETERSBURG.

On the 24th day of January, 1908, a new institution of learning, the Criminological Institute, was opened in St. Petersburg. It can be regarded as the first sprout of the young science of criminology with its related philosophical and sociological branches of knowledge.

This newly established institution, a branch of the Psycho-Neurological Institute, should be named the "Bechterew" Institute,[1] since it was called into life through the indefatigable energy and creative power of the President of the Psycho-Neurological Institute, the academician W. M. Bechterew.

Through the wicked irony of fate, the idea of founding a criminological institute was carried into effect, not in Western Europe, where it had been presented by many competent adepts and was often the topic in International Congresses, but, horrible to relate, with us in Russia, and even at a time when there were hanging over the Russian universities political clouds of a threatening nature.

In this sense, the founding of the Criminological Institute in St. Petersburg is very instructive. This fortunate and symptomatic event shows that dark powers which usually chill social self-activity were not able to smother the impulses of creative mind and personal initiative.

The Criminological Institute of St. Petersburg is the first private institution in the world of this kind, and its founding is due to Professor Bechterew alone.

But an alliance of criminologists, Professors List of Berlin, Prince of Brussels, and Van Hammel of Amsterdam, formed in 1880 (the Russian group in this alliance was formed in 1899), was similar in its leading ideas to the Russian Criminological Institute. Although this alliance had for its task the study of crime as a social evil, yet

[1] The well-known zoologist, Prof. W. A. Wagner, was the one to suggest this name.